

Loneliness in the Daily Lives of Adolescents: An Experience Sampling Study Examining the Effects of Social Contexts

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Abstract

The main aim of the present study was to examine state levels of loneliness in adolescence. Both concurrent associations and temporal dynamics between social contexts and state levels of loneliness were examined. Data were collected from 286 adolescents ($M_{age} = 14.19$ years, 59% girls) by using the Experience Sampling Method. Results showed that adolescents had higher levels of state loneliness when they were alone, compared with being with company. When adolescents were with others, they were most lonely at school and with classmates. Adolescents showed a relief effect when they entered the company of friends after being alone, whereas a spillover effect of solitude was found when adolescents entered the company of family after being alone. Our findings show the dynamics of state loneliness, in that being with classmates increases state loneliness, whereas being with friends reduces loneliness after being alone.

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Introduction

Loneliness is defined as the negative emotional response to an experienced discrepancy between the desired and actual quality or quantity of one's relationships (Perlman & Peplau, 1981), and has been found to be particularly present in adolescence (e.g., Qualter et al., 2013). This increased prevalence of loneliness may be explained by the fact that adolescence is an important period in life in which many physical, emotional, and social changes occur (Steinberg & Morris, 2001). In the social domain, peer relationships become more complex in adolescence, and are characterized by higher levels of intimacy and loyalty, compared with childhood (e.g., Steinberg & Morris, 2001). Adolescents get more involved in small peer groups (i.e., cliques), but also identify themselves with larger groups (i.e., crowds), a tendency that emerges in early adolescence (Davey, Yucel, & Allen, 2008). In addition, adolescents become interested in romantic relations (Collins, Welsh, & Furman, 2009). This heightened complexity of adolescents' social worlds, combined with higher expectancies of their peer relations and increased concern about their social status, could explain why loneliness is particularly present in adolescence (Heinrich & Gullone, 2006; Qualter et al., 2013).

Loneliness is typically examined as a trait by using questionnaires (e.g., the Louvain Loneliness Scale for Children and Adolescents [LLCA], Marcoen & Goossens, 1993; or the University of California, Los Angeles [UCLA] Loneliness Scale, Russell, Peplau, & Cutrona, 1980), measuring to what extent participants feel lonely in general. Although behavioral genetic studies have shown that trait loneliness is moderately heritable (i.e., heritability estimates around 50%), there is still a large component of loneliness that can be explained by environmental factors (Boomsma, Cacioppo, Muthen, Asparouhov, & Clark, 2007). In addition, loneliness may not be a stable trait, but can fluctuate in daily life, depending on, among others, the context people are in (Larson, 1981). The main disadvantage of research on trait loneliness is that it does not take fluctuations and situational effects into account and therefore is not a good reflection of how loneliness is experienced in daily life. By measuring state levels of loneliness in real life, we can gain more knowledge about possible momentary fluctuations in state loneliness, as well as when and in which company adolescents experience state loneliness. In the present study, we focused on loneliness as a state rather than a trait, by examining momentary feelings of loneliness in the daily lives of adolescents.

Social Contexts

Before we discuss how state loneliness is experienced in daily life, it is important to highlight the relevance and function of different social contexts. The time spent in different contexts changes in adolescence. Compared with preadolescents, adolescents spend more time alone, less time with their family, and more time with friends (Larson & Richards, 1991). Based on research that showed that adolescents experience more conflicts with friends and family than children (Laursen, 1993) and the increased importance of peer relations in adolescence (Steinberg & Morris, 2001), it is to be expected that the perceptions of these different social contexts also changes in adolescence. Very few studies have examined how adolescents experience social contexts when they are actually in them.

Based on Social Baseline Theory (Beckes & Coan, 2011), differences between social contexts are to be expected. According to this theory, being with other individuals is considered as a baseline state of relative calmness, as from an evolutionary point of view, being with other human beings would protect an individual from threats from outside the social group, and provides the opportunity to care for each other and share resources. On the contrary, being alone requires increased vigilance for threats because there is no one around to share the risk with, and increased emotion regulation efforts, as there are no others to help the individual to regulate his or her emotions. In this way, an individual has less to worry about when in a social environment, and hence the time in the company of others would be experienced more positively than time alone.

However, Social Baseline Theory also suggests that as humans further developed, and became part of more complex social groups, these benefits of being with others may not be applicable to every type of company. Where intimate company can provide the above-mentioned advantages, non-intimate company may not necessarily provide the opportunity to share outside risks or resources. In some circumstances, non-intimate company may even represent a potential threat, when these individuals compete for similar resources or reject an individual from their social group. These findings highlight the importance of examining how adolescents experience different social contexts, when they are actually in them. Hence, we examined the extent to which adolescents experienced state loneliness in different social contexts in the present study.

State Loneliness in Different Contexts

To date, very few studies have examined state levels of loneliness in adolescence, and only two, relatively dated studies in predominantly White

American samples (Grades 5-8) did so in different contexts (Larson, 1981, 1990). These studies examined whether state levels of loneliness were dependent on location (e.g., home vs. school vs. public places; Larson, 1981) or on the social context (e.g., alone vs. in company; Larson, 1990). Results showed that adolescents had the highest levels of state loneliness when they were alone (Larson, 1990). When considering the location, adolescents were more lonely at home, compared with school and public places (Larson, 1981). However, these studies did not examine whether state levels of loneliness differed according to type of company (e.g., family, friends, or classmates), even though Social Baseline Theory highlights the importance of examining differences between intimate company versus non-intimate company.

In the present study, we examined differences in state loneliness between different contexts. We were not only interested in differences in state loneliness due to location, but also in differences between the types of company the adolescents were with, which has not been examined in previous studies. In addition, the previous studies examining state loneliness measured this construct with a single item (i.e., I feel lonely), whereas we measured state loneliness by a composite scale of four items (i.e., I feel lonely, isolated, left out, and abandoned). These four items measure different aspects of loneliness that are typically measured in trait loneliness measures as well (e.g., "how often do you feel isolated from others," "how often do you feel left out" from the UCLA scale; Russell et al., 1980; "I feel abandoned by my friends" from the LLCA scale; Marcoen & Goossens, 1993). In this way, we obtained a more comprehensive measure of state loneliness.

Temporal Dynamics of Social Contexts in State Loneliness

As mentioned before, previous studies indicated that adolescents experience the highest levels of loneliness when they are alone (Larson, 1981, 1990). However, these studies merely examined concurrent associations. Although the findings from these studies indicate that adolescents experience being alone negatively, we do not know whether this negative experience has a lasting effect on adolescents or whether entering the company of others can have a reducing effect on the possible negative effects of being alone. A promising way to look at associations between being alone and loneliness is by examining time-lagged effects (Marco & Suls, 1993). Marco and Suls (1993) proposed several ways in which a minor stressor (e.g., solitude) and emotions (e.g., loneliness) can be related. We examined whether these descriptive associations were applicable to the relationship between solitude, which was the minor stressor in our study, and state loneliness. Different lagged situations can be distinguished: Situation A refers to two consecutive moments of

solitude, whereas in Situation B adolescents were in company at T-1 and alone at T. Situation C refers to moments in which adolescents were alone at T-1 and in company at T, and Situation D represents two consecutive moments of being in company.

The first descriptive association Marco and Suls (1993) discuss are *spill-over* effects, which are applicable to situations in which solitude at time T-1 is related to higher levels of loneliness at the next assessment (T). This association would indicate that being alone has a lasting effect that is still present at the next time point. This would be the case when state levels of loneliness are higher in Situation A (two consecutive moments of solitude) compared with Situation B (no prior solitude) and when loneliness is higher in Situation C (prior solitude) compared with Situation D (no solitude).

Second, *contrast* effects occur when loneliness increases or decreases in response to the presence or absence of current solitude, being dependent on whether solitude was present or absent during the previous assessment. For example, contrast effects occur when adolescents feel more lonely when they are alone after being in the company of others (Situation B), compared with situations in which they were alone at both time points (Situation A). Finding a contrast effect in these situations indicates that entering solitude causes higher levels of loneliness than being alone at two consecutive time points. Another example of contrast effects is when loneliness is lower in situations when adolescents were alone and subsequently enter the company of others (Situation C), compared with situations in which adolescents were with company at two consecutive occasions (Situation D). A contrast effect in these situations may reflect a feeling of relief; adolescents feel less lonely when they enter the company of others, because they are relieved that they are not alone anymore.

Third, *habituation* occurs when two consecutive moments of solitude are not related to higher levels of loneliness at T than one episode of solitude at T (e.g., when state loneliness is equal in Situation A and Situation B). No research has been conducted on the temporal dynamics between the social context and state loneliness. However, Larson and colleagues (Larson, 1997; Larson, Csikszentmihalyi, & Graef, 1982) did examine how adolescents felt after a period of solitude. They examined differences in loneliness between Situations C and D, and found a contrast effect. After being alone and returning to the company of others (Situation C), adolescents experienced higher levels of positive affect than at times they were in the company of others, without having been alone before (Situation D).

In the present study, we examined differences in state loneliness between the previously described situations (Situation A vs. B and Situation C vs. D), in order to decide which of the descriptive associations just mentioned are

applicable (i.e., spillover, contrast, or habituation). In addition, because we expected differences between the type of company adolescents are in, we also examined differences between the company of classmates, friends, and family. Importantly, the results from these temporal relations will provide further insight into the experience of solitude in adolescence, and whether different types of social company can reduce possible negative effects of being alone.

Sex Differences

Previous studies have been inconsistent regarding sex differences in trait levels of loneliness in adolescence. Some studies found girls to have higher levels of loneliness (Vanhalst et al., 2012), whereas others reported higher levels in boys (e.g., Hoza, Bukowski, & Beery, 2000), but most studies found no sex differences in trait levels of loneliness (e.g., Bowker & Spencer, 2010; Jobe-Shields, Cohen, & Parra, 2011). However, to our knowledge, sex differences have not been examined in state levels of loneliness.

In addition, several studies have shown that boys and girls experience social relations differently. For example, girls in general report receiving more provisions from their friendships, such as closeness, affection, nurturance, and acceptance (Jobe-Shields et al., 2011). In addition, girls generally report receiving higher levels of parental support than boys (Bowker & Spencer, 2010). Hence, differences may exist in how boys and girls perceive their social context. Therefore, the present study examined whether state levels of loneliness differed for boys and girls, and whether boys and girls had different levels of state loneliness in different social contexts.

The Present Study

The main goal of this exploratory study was to examine state levels of loneliness in different social contexts and different locations. First, we examined whether state loneliness differed between situations in which adolescents were alone or with company. Based on previous research and Social Baseline Theory, we hypothesized that adolescents would be more lonely when they were alone. Next, we examined for both situations (i.e., alone and with company) whether state levels of loneliness differed between the locations adolescents were in (i.e., home, school, and other locations). Based on the findings by Larson (1981), we expected that adolescents would have the highest levels of state loneliness when they were at home, compared with other situations. When adolescents were with company, we examined whether state levels of loneliness differed between different types of company

(i.e., family, friends, classmates, and others). Because adolescents experience more positive affect and more positive interactions when they are with friends compared with family (Larson, 1983), we expected adolescents to have lower levels of loneliness when they are with friends, compared with other types of company. Next, we examined the temporal dynamics of social context on state loneliness. We expected that adolescents would experience highest levels of loneliness when they were alone at T, independent of whether they were alone or in company at T-1. In other words, we did not expect differences between Situations A and B, which would be indicative of a habituation effect. Furthermore, similarly to Larson (1997), we expected a relief effect when adolescents would enter the company of others at T after being alone at T-1 (i.e., lower levels of loneliness in Situation D, compared with Situation C). However, we expected this relief effect only for entering the company of intimate others such as family and friends, as according to Social Baseline Theory, non-intimate others such as classmates may not have similar benefits as intimate company.

For all relationships, we examined sex differences. Because previous studies found that girls value their social relations more highly than boys (Jobe-Shields et al., 2011), we expected girls to be more lonely when they were alone, compared with boys. In addition, we hypothesized girls to be less lonely than boys in the company of others, especially friends. For the temporal dynamics of state loneliness we did not have specific hypotheses regarding sex differences.

Method

Participants

Our sample consisted of 303 adolescents, aged between 13 and 16 years ($M_{age} = 14.19$, $SD = 0.55$). Of this sample, 59% were female and 97.3% were born in the Netherlands. All adolescents were in their second year of secondary school. The different types of education were well-represented in the sample: 23.4% of the adolescents attended preparatory secondary school for technical and vocational training, 35.8% attended preparatory secondary school for professional education, and 40.8% attended preparatory secondary school for university. The present study was approved by the Medical Ethical Committee Arnhem-Nijmegen, The Netherlands. Data were collected in four schools, all in the Eastern part of the Netherlands. Adolescents and their parents provided informed consent. Of the total group of adolescents that were contacted ($N = 933$), 32.5% of the adolescents agreed to participate.

Procedure

The study consisted of a baseline questionnaire and momentary assessments. The baseline questionnaire, in which demographic variables such as sex, age, and educational level were measured, was administered 2 to 8 weeks before the start of the momentary assessments. Daily data were collected by using the Experience Sampling Method (ESM; Myin-Germeys et al., 2009), which is used to assess adolescents' experiences in their daily living environment. Adolescents carried a smartphone on six consecutive days (including the weekend), receiving a signal at 9 random times a day, after which they had to fill out a questionnaire on the smartphone. Adolescents were instructed to turn on the smartphone when they woke up in the morning, and turn it off when they went to bed in the evening. When adolescents did not respond within 2 minutes, a reminding signal was emitted (with a maximum of three reminders). After adolescents filled out the questionnaire, a text message was sent to the principal investigator, making it possible to check compliance and contact adolescents when compliance was not high enough. All adolescents participated during school weeks, and adolescents had to fill out questionnaires during school hours as well. Adolescents received a reward of €20 (i.e., about US\$27) when they completed at least 55% of the momentary assessments (78.5%; $n = 238$).

Measures

State levels of loneliness. Because previous ESM studies measured loneliness by one item only (i.e., I feel lonely), we created new items to measure momentary loneliness. We used four items: lonely, isolated, left out, and abandoned. At each momentary assessment, adolescents had to rate to what extent they experienced the described emotion on a 7-point scale ranging from (1) *not at all* to (7) *very much*. We calculated Cronbach's alpha for each momentary assessment separately, and averaged the values over all momentary assessments. This resulted in an alpha of .73. Inter-item correlations ranged from $r = .40$ to $r = .54$.

Social contexts. At each momentary assessment, adolescents rated whether they were alone or with others. When they were with others, they described in an open-ended question who that company was. These responses were coded to represent family (e.g., parents or siblings), friends, classmates, or others (e.g., team mates or teachers). To calculate the inter-rater reliability, 10% of the total number of assessments in company ($n = 676$) were randomly selected and coded by a different rater. This resulted in a kappa

of .97 ($p < .001$), indicating good inter-rater reliability. To be able to examine the lagged relations between different social contexts and state loneliness, we first determined for each assessment which of the four situations was applicable. In order to compare Situation A versus B and C versus D, we created dummy variables representing the different types of situations (e.g., for A vs. B, all assessments at which Situation A was applicable received the code 0, and all situations in which Situation B was applicable received the code 1).

Locations. In addition to social contexts, participants described in an open-ended question where they were at each assessment. These responses were coded to represent home, school, and other locations (e.g., supermarket or friends' home). To calculate the inter-rater reliability, 10% of the total number of assessments ($N = 1,106$) were randomly selected and coded by a different rater, which resulted in a kappa of .92 ($p < .001$), showing that the inter-rater reliability was good. We created dummy variables representing the different locations.

Momentary Data Preparation

The total dataset consisted of 10,865 momentary assessments. The average number of completed momentary assessments per adolescent was 37 ($SD = 11.12$) out of a maximum of 54 (6 days times 9 assessments per day). Of the total sample of adolescents, 17 adolescents (i.e., 5.61%) completed less than one third of the total number of momentary assessments (i.e., <18 out of a maximum of 54), which was the minimum to be included in the analyses. Attrition analyses were conducted to examine whether the excluded adolescents ($N = 17$) differed from the included adolescents ($N = 286$) on demographic characteristics (i.e., sex, age, educational level). No significant differences were found ($p > .05$).

Data Analyses

First, we calculated descriptive statistics for state levels of loneliness and the percentage of occasions in different social contexts. State levels of loneliness were aggregated within persons. The percentages of occasions in different contexts represent the proportion of the total number of assessments adolescents spent in the different contexts.

Third, we examined whether state levels of loneliness differed between the contexts adolescents were in. Because our repeated momentary assessments (Level 1) were nested within individuals (Level 2), we conducted multilevel linear regression analyses in Mplus (Muthén & Muthén, 1998-2007).

We first tested these associations for boys and girls together. However, because we expected sex differences, we subsequently compared the results for boys and girls, by conducting multi-group analyses across sex. We examined whether the model in which the paths were allowed to differ between boys and girls had a significantly better model fit than the model in which the paths were constrained to be equal for boys and girls, using a chi-square difference test ($\Delta\chi^2$). If significant differences between boys and girls emerged, we further compared differences between boys and girls per path, by examining whether the model fit of the model in which the path of interest was allowed to differ between boys and girls was significantly better than the model fit for the model in which all paths were constrained, also by using the chi-square difference test. In this way, significant model fit differences indicated whether the paths of interest specifically differed between boys and girls. Importantly, in all multilevel models, no missing data were imputed, as we only used the data that were available for each adolescent. For example, when an adolescent filled out 20 assessments in total, that was the number of assessments that were included in the analyses.

Next, we examined whether state loneliness differed between situations in which adolescents were alone compared with situations in which adolescents were with company, by adding a dummy variable in the model for being with company. In this way, the intercept reflected the level of loneliness when adolescents were alone, and the coefficient for the dummy variable reflected whether the level of loneliness when adolescents were in company differed from the level of loneliness when adolescents were alone. In the next model, we examined whether levels of state loneliness differed between the different locations in which adolescents were alone, by including dummy variables in the model for being alone in school versus other locations versus home. We tested two models with different reference groups (i.e., home and school, respectively), to examine all possible differences between locations. The same was done for situations in which adolescents were with company.

In the subsequent multilevel models, we tested whether state loneliness differed between situations alone and the different types of company, and between the different types of company (i.e., family, friends, classmates, and others) by adding dummy variables to the model. To examine the differences between type of company, we tested three models with different reference groups (i.e., family, friends, and classmates, respectively).

Finally, we tested whether the effects of being alone or with company were dependent on their social context at the previous assessment (see Table 1), again by using multilevel modeling. In all models, state loneliness at T was the dependent variable, which was predicted by a dummy variable representing Situation A versus B or Situation C versus D. All lagged relations were

Table 1. Temporal Dynamics of Social Contexts on State Levels of Loneliness.

| Model | Situation A | | Situation B | |
|-------|-------------|------------|-------------|------------|
| | T-1 | T | T-1 | T |
| 1. | Alone | Alone | Family | Alone |
| 2. | Alone | Alone | Friends | Alone |
| 3. | Alone | Alone | Classmates | Alone |
| Model | Situation C | | Situation D | |
| | T-1 | T | T-1 | T |
| 4. | Alone | Family | Family | Family |
| 5. | Alone | Friends | Friends | Friends |
| 6. | Alone | Classmates | Classmates | Classmates |

Note. Dummy variables were created in which Situation A = 0, Situation B = 1 and Situation C = 1, Situation D = 0.

examined within days and we controlled for state loneliness at T-1. As the time elapsed between two subsequent assessments may influence the results, we controlled for this in all analyses by including the elapsed time between two assessments as a covariate.

Results

Descriptive Statistics

First, we calculated descriptive statistics for state levels of loneliness, for boys and girls separately (see Table 2). No differences were found between boys and girls in state loneliness. Compared with the range of the loneliness measure (i.e., 1-7), mean levels were relatively low ($\bar{X} = 1.31$), but comparable with levels of negative affect in other adolescent samples (Schneiders et al., 2007). Next, the percentage of occasions in different social contexts (i.e., alone, with family, with friends, with classmates, and with others) was calculated for each adolescent. As can be seen in Table 2, adolescents were alone (36% for girls, 43% for boys) and with classmates (26% for girls, 27% for boys) during most assessments. Boys were alone on more occasions than girls, and girls were with family, friends, and others on more occasions than boys.

Second, we examined correlations between state loneliness and being in different social contexts (Table 3). For both boys and girls, state levels of loneliness were positively related to being alone, and negatively related to

Table 2. Descriptive Statistics, Split by Sex.

| Variable | Boys | | Girls | | <i>t</i> | <i>df</i> |
|-----------------------------------|----------------|----------|----------------|--------|----------|-----------|
| | \bar{X} (SD) | Range | \bar{X} (SD) | Range | | |
| State loneliness | 1.29 (0.39) | 1-2.97 | 1.34 (0.68) | 1-3.39 | -1.49 | 282 |
| Time alone ^a | 42.51 (15.76) | 4.3-84.6 | 35.55 (14.38) | 0-73.2 | 4.41*** | 282 |
| Time with family ^a | 19.31 (13.03) | 0-54.3 | 23.86 (13.08) | 0-63.2 | -2.88** | 282 |
| Time with friends ^a | 8.90 (7.53) | 0-29.3 | 12.91 (10.61) | 0-52 | -3.73*** | 282 |
| Time with classmates ^a | 26.99 (10.21) | 0-54.2 | 25.30 (8.30) | 4-52.6 | 1.48 | 213 |
| Time with others ^a | 1.74 (2.85) | 0-14.6 | 2.92 (4.41) | 0-37.8 | -2.75** | 281 |

^aMeans represent the proportion of the total number of assessments that adolescents were in that specific context (in percentages).

* $p < .05$. ** $p < .01$. *** $p < .001$.

being with family. These findings indicated that higher mean levels of state loneliness are related to being alone more, and lower mean levels of state loneliness are related to being with family more.

State Loneliness in Different Social Contexts and Locations

Third, we examined whether state levels of loneliness differed between the contexts adolescents were in. We tested the unconditional model first, including only a constant and state loneliness. The intra-class correlation was .37, indicating that 37% of the variation in state loneliness occurred at the individual level (Level 2). Furthermore, the variances in state loneliness were significant at the momentary assessment level (Level 1 variance = .27) and the individual level (Level 2 variance = .16).

Next, we examined whether state loneliness differed between situations in which adolescents were alone compared with situations in which adolescents were with company. Adolescents had significantly lower levels of state loneliness when they were with company ($B = -.09$, $p < .001$), compared with when they were alone ($B = 1.38$, $p < .001$). No significant differences were found between boys and girls, $\Delta\chi^2(1) = 0.50$, $p > .05$.

In the next model, we examined whether levels of state loneliness differed between the different locations in which adolescents were alone, by including dummy variables in the model for being alone in school versus other locations versus home (Table 4). No differences in state loneliness were found between the different contexts in which adolescents were alone, and no significant differences were found between boys and girls, $\Delta\chi^2(2) = 1.97$, $p > .05$. The next

Table 3. Correlations Between State Loneliness and Being in Different Social Contexts, Split by Sex.

| Variable | 1. | 2. | 3. | 4. | 5. | 6. |
|--------------------------|-------|---------|---------|---------|---------|------|
| 1. State loneliness | — | .27** | -.22** | -.10 | -.02 | .06 |
| 2. Being alone | .25** | — | -.61*** | -.29*** | -.29*** | -.15 |
| 3. Being with family | -.22* | -.61*** | — | -.30*** | -.06 | -.11 |
| 4. Being with friends | -.17 | -.23* | -.25** | — | -.27*** | -.03 |
| 5. Being with classmates | -.00 | -.57*** | -.08 | -.05 | — | -.13 |
| 6. Being with others | .07 | -.05 | -.20* | .01 | .03 | — |

Note. Values above the diagonal are correlations for girls, values below the diagonal are correlations for boys.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4. Levels of Loneliness When Alone or in Company, Split for Differences Between Locations.

| Parameter | Situations alone | | | Situations in company | | |
|-----------|---------------------|---------------------|----------------|-----------------------|---------------------|-------------------|
| | Home | School | Other | Home | School | Other |
| Intercept | 1.38 (.03)***, a | | | 1.24 (.02)***, a | | |
| B (SE) | | 0.06 (.04) | 0.01 (.04) | | 0.09 (.02)*** | -0.00 (.02) |
| Intercept | | 1.44 (.05)***, a | | | 1.33 (.03)***, a | |
| B (SE) | -0.06 (.04) | | -0.05 (.05) | -0.09 (.02)*** | | -0.09 (.02)*** |

Note. The Bs represent the difference in state loneliness between the dummy variable and the reference category.
aThese parameters (i.e., the intercepts) represent the level of loneliness for the reference group (i.e., when the dummy variable was 0).
* $p < .05$. ** $p < .01$. *** $p < .001$.

step was to examine whether loneliness differed between the locations in which adolescents were with company (i.e., home, school, and other locations). Adolescents were more lonely when they were in company at school, compared with being in company at home or in other locations. No differences were found in state loneliness between being at home and being in other locations. No sex differences were found for these relations, $\Delta\chi^2(2) = 1.63, p > .05$. In addition, we examined whether levels of loneliness differed between situations in which adolescents were alone, compared with situations in

Table 5. Levels of Loneliness in Different Social Contexts.

| Parameter | Alone | Family | Friends | Classmates | Others |
|-----------|------------------------------|----------------------------|------------------------------|------------------------------|---------------------------|
| Intercept | 1.38 (.03) ^{***, a} | | | | |
| B (SE) | | -0.13 (.02) ^{***} | -0.11 (.03) ^{***} | -0.05 (.02) [*] | -0.13 (.05) ^{**} |
| Intercept | 1.24 (.02) ^{***, a} | | | | |
| B (SE) | | | 0.03 (.02) | 0.09 (.02) ^{***} | 0.02 (.05) |
| Intercept | | | 1.27 (.02) ^{***, a} | | |
| B (SE) | | -0.03 (.02) | | 0.06 (.02) ^{**} | -0.01 (.05) |
| Intercept | | | | 1.33 (.03) ^{***, a} | |
| B (SE) | | -0.09 (.02) ^{***} | -0.06 (.02) ^{**} | | -0.07 (.05) |

Note. The Bs represent the difference in state loneliness between the dummy variable and the reference category.

^aThese parameters (i.e., the intercepts) represent the level of loneliness for the reference group (i.e., when the dummy variable was 0).

* $p < .05$. ** $p < .01$. *** $p < .001$.

which they were with family, friends, classmates, or others (Table 5). We found that state loneliness was lower when adolescents were with any type of company (i.e., family, friends, classmates, or others) compared with being alone. No sex differences were found for this model, $\Delta\chi^2(4) = 3.96, p > .05$.

Next, we examined differences between the types of company adolescents were with (i.e., family, friends, classmates, and others). As can be seen in Table 5, adolescents had significantly lower levels of loneliness in situations in which they were with friends and family, compared with situations in which they were with classmates. No differences were found between the other situations. In addition, no differences were found between boys and girls, $\Delta\chi^2(3) = 3.41, p > .05$.

Temporal Dynamics of Social Contexts on State Loneliness

In the next models, we tested whether the effects of being alone or with company were dependent on the social context at the previous assessment (see Table 1). We controlled for the time elapsed between each two consecutive assessments in a day in all analyses ($\bar{X}_{time(\text{in minutes})} = 101.77, SD = 77.75$). Importantly, including this variable did not change the results.

We first examined the three models (Models 1-3 in Table 1) in which Situation A (two consecutive assessments in solitude) was compared with Situation B (no prior solitude). No differences were found in levels of loneliness between these situations (see Table 6). This finding indicated that being alone at the current assessment has the strongest effect on loneliness, independent of whether adolescents were alone or with friends, family or

Table 6. Model Results for Temporal Dynamics of State Loneliness.

| Model | Situation A (alone-alone) | Situation B (company-alone) |
|-------------|-----------------------------|-------------------------------|
| All company | 1.39 (.03)*** | 0.01 (.02) |
| Family | 1.39 (.03)*** | -0.03 (.03) |
| Friends | 1.40 (.03)*** | -0.02 (.04) |
| Classmates | 1.39 (.03)*** | 0.06 (.03) |
| Model | Situation C (alone-company) | Situation D (company-company) |
| All company | -0.03 (.02) | 1.29 (.02)*** |
| Family | 0.04 (.02)* | 1.21 (.02)*** |
| Friends | -0.08 (.03)** | 1.26 (.04)*** |
| Classmates | -0.02 (.04) | 1.34 (.03)*** |

* $p < .05$. ** $p < .01$. *** $p < .001$.

classmates at the previous assessment. This is indicative of a habituation effect, as adolescents are as lonely when they are alone in two consecutive moments compared with when they are alone on one moment. In addition, no sex differences were found, $\Delta\chi^2(2)$ ranged between 0.87 and 3.16, $p > .05$.

Next, we examined whether levels of loneliness differed between Situations C (prior solitude) and D (no solitude). For the situations in which adolescents were with family at T (Model 4 in Table 1), we found higher levels of loneliness in Situation C, compared with Situation D. This result indicated that being alone at T-1 has a spillover effect on loneliness at T, because adolescents were more lonely in situations in which they were alone at the previous assessment (T-1), even though they were in the company of their family at the current assessment (T). No sex differences were found, $\Delta\chi^2(2) = 1.43$, $p > .05$. For the situations in which adolescents were with friends at T (Model 5 in Table 1), lower levels of loneliness were found in Situation C, compared with Situation D. In situations in which adolescents were with friends at the current assessment, they were less lonely when they were alone at the previous assessment, compared with situations in which they already were with friends at T-1. This is indicative of a contrast effect, and more specifically, a relief effect. No significant differences were found between boys and girls, $\Delta\chi^2(2) = 2.24$, $p > .05$. Finally, for situations in which adolescents were with classmates, no differences were found between Situations C and D. The model in which all paths were allowed to differ by sex showed a significantly better model fit compared with the model in which all paths were constrained, $\Delta\chi^2(2) = 9.96$, $p < .05$. Therefore, we further checked whether this sex difference was due to the dummy variable

representing Situation C versus D, which was not the case, $\Delta\chi^2(1) = 0.56, p > .05$, showing that for boys and girls, no differences in state loneliness were found between Situations C and D.

Discussion

In the present study, in which the ESM was used, we examined state levels of loneliness in different social contexts and locations in a sample of early adolescents. Our main finding was that adolescents experienced higher levels of loneliness when they were in company at school, compared with being in company at home and other locations. These findings are not in line with previous research, in which it was found that adolescents are more lonely at home than at school (Larson, 1981). In addition, we found a spillover effect when adolescents were alone at T-1, and with family at the consecutive assessment, which means that being alone had a lasting effect on adolescents' levels of state loneliness. The opposite was found for being with friends; when adolescents were alone at T-1 and entered the company of friends at T, they had significantly lower levels of loneliness than in two consecutive assessments with friends. This is a contrast effect: adolescents may feel relieved that they are not alone anymore.

State Loneliness in Different Contexts

We found that when adolescents were in company, they were more lonely at school than at home and other places. A possible explanation for this finding may be that school is a context in which peers are always present, which increases the opportunities for peer rejection or negative peer interactions. In addition, going to school is obligatory, and adolescents are not free to choose their classmates, suggesting that they will also be confronted with peers they may not particularly like or who may be socially threatening or rejecting. Therefore, their levels of loneliness may be higher in school, compared with home and other locations. However, Larson (1981) found that adolescents had lower levels of state loneliness at school, which is in contrast with our results. A possible explanation for the differences in findings may be that adolescents in our sample are likely to use virtual media to stay in touch with their friends. Hence, although they are at home, they may still be interacting with their peers through text messaging or social media. In the 1980s, these technologies were not yet available, which could explain the higher loneliness levels at home in that sample. Hence, as adolescents in our sample may have been more connected with their peers when at home, lower levels of loneliness were found at home, compared with school. In contrast,

adolescents in Larson's sample were less able to keep in touch with their friends at home, and therefore that study found that adolescents were more lonely at home than at school. An alternative explanation for the difference in findings may be the measurement of state loneliness, as Larson (1981) used only one item to measure loneliness (i.e., I feel lonely) and we used four items. Therefore, we checked whether our results would change when we used only that item in our analyses. Some of the results were slightly less strong, compared with the analyses with the composite loneliness measure, but the direction of results did not change. Hence, the difference in measurement of state loneliness could not explain the difference in results between our study and that of Larson (1981).

When comparing situations in which adolescents were alone with situations in which they were with different types of company, we found that adolescents were less lonely when they were in any type of company, compared with being alone, which is in line with Social Baseline Theory (Beckes & Coan, 2011). Related to this and also in line with Social Baseline Theory, we found that both boys and girls experienced higher levels of loneliness when they were with classmates, compared with friends and family. Being with classmates seems to be a negative situation, in which adolescents feel more lonely than in situations when they are with friends or family. This difference in state loneliness may be due to a difference in the level of closeness with family and friends versus classmates. Because classmates are peers who adolescents do not voluntarily choose to be with, the relations adolescents have with classmates are likely to be of lower quality compared with the relations they have with their friends. Therefore, adolescents may feel more lonely when they are in company that they do not necessarily have good relations with (in this case, classmates). Furthermore, according to Social Baseline Theory, non-intimate company such as classmates may not have the same beneficial effects as intimate company, as classmates may to some extent represent a threat to adolescents. In addition, research on peer relations has shown that children and adolescents who are rejected or victimized by their peers experience high levels of loneliness (for review, see Asher & Paquette, 2003), which could imply that adolescents who experience high levels of state loneliness with their peers are those who are rejected or victimized by their classmates. However, we did not have information on peer status or victimization in the present study. Further research is warranted to examine (a) whether the level of closeness with company in daily life affects state loneliness levels and (b) whether the level of rejection experiences affects the level of state loneliness experienced in different social contexts.

Interestingly, for both boys and girls, there were no differences in levels of loneliness between being with family or friends. Previous research found

higher levels of positive affect when adolescents were with peers or friends, compared with family (Larson, 1983; Silk et al., 2011). When interpreting these findings in combination with the findings of the present study, the available evidence could indicate that although being with friends leads to higher levels of positive affect, being with family can fulfill the need for social relations as well as being with friends, because state levels of loneliness did not differ between those situations.

Although the present study is a first step in exploring loneliness in daily life and further research is needed, some suggestions for intervention may be made. Our results indicate that adolescents are most lonely with classmates and at school. In order to reduce state loneliness levels at school, schools may focus on establishing a positive social climate. Previous research has shown that teachers may play an important role in establishing such a positive climate, as teacher attunement to peer group affiliations was related to more positive perceptions of the social environment in their students (Hamm, Farmer, Dadisman, Gravelle, & Murray, 2011). Furthermore, positive teacher-student interactions are found to increase positive peer interactions in the classroom (Luckner & Pianta, 2011). Importantly, it has been shown that teacher attunement can be trained, as an intervention focused on teaching social dynamics increased teacher attunement in sixth-grade teachers (Hamm et al., 2011).

Temporal Dynamics of Social Contexts on State Loneliness

Regarding the temporal dynamics of social contexts on state loneliness, we did not find differences in loneliness when being alone at two consecutive assessments (Situation A) versus being with company at T-1 and alone at T (Situation B; see Table 1 for all situations). This finding is indicative of habituation. Adolescents may adapt to the situation of being alone, and therefore do not feel more lonely when they are alone at two consecutive time points, compared with being alone at one time point. For both boys and girls, we found differences between two consecutive assessments in company (Situation D) and being alone at T-1 and in company at T (Situation C), depending on the type of company.

When adolescents were alone at T-1 and entered the company of friends at T, they had significantly lower levels of loneliness than in two consecutive assessments with friends. This finding can be interpreted as a relief effect. Levels of loneliness may be lower in situations in which adolescents enter the company of friends after solitude, because they are relieved that they are not alone anymore. These findings are in line with studies from Larson and colleagues on affect and solitude (Larson, 1997; Larson, Csikszentmihalyi, &

Graef, 1982), in which it was found that adolescents experienced higher levels of positive affect when they entered the company of others after a period of solitude, compared with situations in which they were in company at both time points.¹ Larson interpreted this finding as a positive aftereffect of solitude, whereas we interpreted this finding as a relief effect. Hence, although our finding is similar to that of Larson, the interpretation of this finding is different. We interpreted it as a relief effect, because being alone was related to higher levels of loneliness, and likely represents a relatively negative experience for adolescents. This would also be in line with Social Baseline Theory, which states that being alone is a negative situation for individuals. Therefore, when adolescents feel less lonely when they enter the company of others, it seems more logical to assume relief for being in a more positive situation (i.e., with others instead of being alone) rather than a positive aftereffect of this (negative) situation. In addition, when the interpretation of a positive aftereffect would be correct, it could be expected that this effect will be present irrespective of the company adolescents are in after having been alone. However, we only found this effect for the company of friends, but not the company of family or classmates. We think it is more likely that for state loneliness, this finding represents a relief effect. Yet, further research is necessary to examine which interpretation is more likely.

We found opposite results for situations with family. When adolescents were alone at T-1 and with family at T, they had higher levels of loneliness than in situations in which they were with family at both time points. This is a spillover effect, which means that being alone has a lasting effect on adolescents' levels of state loneliness that is still present when they are with family at the next assessment. Hence, although we did not find differences in overall levels of state loneliness between being with family and friends, these results do indicate that family and friends play a different role when adolescents were alone at the previous assessment. Family members cannot compensate the negative aftereffects of solitude, whereas friends seem to reduce these negative effects. This may be explained by the type of activity adolescents engage in with friends and family, as previous Experience Sampling studies have shown that interactions with friends were rated more positively than interactions with family (Larson, 1983). Therefore, entering the company of friends after a period of solitude may be more rewarding and therefore lead to greater decreases in loneliness, than entering the company of family, because the interactions are more positive. These findings might imply that adolescents who experience loneliness when alone could be advised to seek the company of their friends, as our results showed that only friends could reduce the negative effects of being alone.

Solitude

In the present study, we found that in general, solitude is related to higher levels of state loneliness, for both boys and girls. This finding could lead to the conclusion that being alone is a negative period for early adolescents, which should perhaps be avoided. However, previous studies have also shown that a moderate amount of solitude is related to better psychological adjustment in adolescence (Larson & Csikszentmihalyi, 1980) and that adolescents more often voluntarily choose to be alone, compared with children (Larson, 1997). In addition, adolescents report to use time alone to concentrate on an activity, think, or cope with emotions (Larson & Csikszentmihalyi, 1980; Larson et al., 1982). These findings also point to the benefits of solitude in adolescence. Hence, although levels of state loneliness may be higher, adolescents may also use time spent alone constructively. In future studies, it may be interesting to examine whether levels of state loneliness when adolescents are alone are lower in situations in which they report to use this time alone for a specific reason, or when they report that it was their own choice to be alone. For example, it could be that adolescents feel less lonely when they are alone because they need to concentrate on homework for example, compared with situations in which they did not choose to be alone.

Strengths and Limitations

One of the main strengths of the present study is that we used the ESM. In this way, it was possible to examine state levels of loneliness in adolescents' everyday life, thereby reducing recall bias and increasing ecological validity (Myin-Germeys et al., 2009). In addition, the present study is among the first to examine state levels of loneliness in adolescence, which is a particularly important period for the development of trait levels of loneliness (Qualter et al., 2013).

Despite these strengths, some limitations have to be mentioned. First, because adolescents had to provide active consent, we may have selected a relatively healthy sample, with low levels of problem behavior. We do not have information from adolescents who declined participation, therefore, we do not know what their reasons were. Yet, the levels of loneliness in our sample are comparable with those in other community samples (Doane & Adam, 2010; Marcoen & Goossens, 1993), which indicates that we did not have a biased sample concerning levels of loneliness.

Second, we asked adolescents to report whether they were alone or in company. We did not further specify the situation in which adolescents

were alone, whereas Larson (1990) states that situations in which adolescents are exchanging information with other people should be seen as situations in which they are with company. In our study, this would include situations in which adolescents were alone but talking on the phone, or involved in social networking on the Internet. However, Larson did not actually test whether there were differences in, for example, positive and negative affect between those situations. Therefore, and because we did not have data on communicating with others when alone, we do not know whether this could have influenced our results. It is important to stress, however, that recent research has shown that using social media such as Facebook at a given moment was related to a decrease in well-being at the next moment (Kross et al., 2013), which implies that staying in touch with peers through virtual media may not necessarily be positive. As virtual media become increasingly popular, it is important to examine in future studies whether levels of state loneliness are affected by the use of virtual media. In addition, we did not measure whether adolescents chose to be alone, which may have influenced the results. Adolescents may be less lonely when they are alone because they want to be alone, compared with situations in which they did not choose to be alone. Future studies could include a question that measures whether adolescents chose to be alone. Relatedly, adolescents reported where they were, but when they were at school, we could not distinguish class situations from break times. These situations may be related to different levels of state loneliness. For example, break times provide more freedom to interact with others, which can be both positive (e.g., interacting with friends) and negative (e.g., more opportunities for bullying; Craig, Pepler, & Atlas, 2000). Future studies should try to distinguish between those situations, in order to obtain a more complete picture about levels of state loneliness in school.

Third, the measure of state loneliness was developed for the present study. Although it showed adequate reliability, inter-item correlations were moderate, and the measure has not been validated in other studies. Importantly, we want to stress that it may not be surprising that inter-item correlations were only moderate, as the different items represent different aspects of loneliness. For example, adolescents may feel left out when they are with peers without responding to the item "I feel lonely," whereas they may feel more lonely and less left out when they are alone. Further research is needed to examine whether this measure proves to be valid as well. Related to this, we could not further distinguish between the experience of emotional loneliness (i.e., absence of a close dyadic relationship), and social loneliness (i.e., absence of a social network), as our state loneliness measure did not capture those different aspects of loneliness. Future research could examine whether the

relations between social contexts and state loneliness are different for social and emotional loneliness.

Fourth, our compliance rate (i.e., 69%) is moderate compared with other ESM studies in adolescents that had higher compliance rates (e.g., Schneiders et al., 2007). There may be several reasons for this difference in compliance rates. Whereas traditional ESM studies used wristwatches that emitted beeps and paper-and-pencil questionnaires, we used smartphones that emitted buzzing signals. Adolescents may have put the smartphones in their pockets or bags and therefore could have missed a buzzing signal. A beep emitted by a wristwatch may be less likely to be missed. However, we had clear reasons to use smartphones and buzzing signals. We used buzzing signals in order to minimize the disturbance in classrooms. In our opinion, it would not have been possible to convince schools to participate with multiple students at the same time, when we would have used beeps. Furthermore, we chose to use smartphones because it made the administration of the questionnaires easier and less time-invasive for adolescents, and made it possible for us to check compliance, as we received a message when adolescents completed a questionnaire. In addition, because the data were stored on the smartphone and messages were sent to us after each questionnaire, adolescents were not able to fill out the questionnaires all at once, which may be a problem with paper-and-pencil questionnaires. Hence, although there are some downfalls to using smartphones and buzzing signals, we feel that the advantages outweigh the disadvantages.

Finally, as this was one of the first studies on adolescent state loneliness, we did not use stringent statistical tests. More conservative approaches that control for the number of comparisons made, for instance, should be used when following up on this exploratory effort.

Conclusion

In sum, the main findings of this exploratory study were that state loneliness is higher when adolescents were alone, compared with when they were with others. Our findings showed that school was a relatively negative environment, in that levels of loneliness were higher at school and with classmates, compared with other situations. Adolescents showed a spillover effect of solitude on state loneliness when they were alone and entered the company of family. In contrast, adolescents showed a relief effect when they were alone first and subsequently in the company of friends. These findings provide insight into the prevalence and dynamics of state loneliness in early adolescence. Additional research on the specific role of different social contexts and social media is necessary to further disentangle the dynamics of state levels of loneliness.

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Note

1. In the present study, state levels of loneliness were negatively correlated with state levels of positive affect ($r = -.32$), showing that it makes sense to compare the findings on the positive aftereffect of solitude in the present study with Larson's findings.

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